Aviation System Monitoring and Modeling (ASMM) — Modeling and Simulation of Clear Air Turbulence Detection and Response

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An operationally-interesting scenario within the aviation system was modeled successfully, linking a simulation of air traffic in a region of airspace with models of multiple pilots and controllers. Textual and quantitative data collected through intra-mural and extra-mural monitoring were used to support the development and validation of models of causal relationships and predictions to support safety risk assessment. The technologies demonstrated by this accomplishment will enable aviation safety predictions and risk assessments through the development and validation of system-wide models and simulations.

The model included 12 aircraft operating in an en-route sector with clear-air turbulence (CAT). It specified an experimental design of simulation runs to assess the impacts of CAT sensor technology in that sector. Traffic volumes and routes for the scenario were derived from ETMS (Enhanced Traffic Management System) data for an en-route sector in the Boston ARTCC (Air Route Traffic Control Center. These data specified flight crew and controller procedures and communications related to transiting the sector with CAT events. An agent-based model of the scenario was developed where each agent acted and interacted in accordance with its own internal rules and conditions. The model included agents for controllers, flight crews, aircraft, radar surveillance, communication channels, CAT weather events, and sensors. It demonstrated the viability of the overall approach to airspace modeling based on agent-based simulation and event-driven, asynchronous modeling with selective resynchronization for fast-time simulation.